Canada-Newfoundland

CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION AGREEMENT

FUEL PEAT IN NEWFOUNDLAND

89-01938/

CANADA/NEWFOUNDLAND CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION PROGRAM

In June 1979, to help meet the demand for energy conservation and to encourage the search for alternative sources of energy, the Government of Canada and the Government of Newfoundland and Labrador signed the Conservation and Renewable Energy Demonstration Agreement (CREDA).

This five year, $11,250,000 cost shared program (Federal 80% - Provincial 20%) ended March 31, 1985. Information obtained from project demonstrations is now available to the public.

Canada-Newfoundland

CONSERVATION AND RENEWABLE ENERGY DEMONSTRATION AGREEMENT

FUEL PEAT IN NEWFOUNDLAND

Contents

Introduction 3
Peat Bog Preparation 6
Harvesting Peat 8
Energy Applications 10
Environmental Considerations 11
Conclusion 12
References 12

89-01938/

Design and Layout: Ted Mills and Associates Limited
Printed by: Creative Printers and Publishers Limited
Published by: Energy Branch, Department of Mines and Energy
Government of Newfoundland and Labrador
ISBN NO: 0-920769-14-4
Date: December, 1985

INTRODUCTION

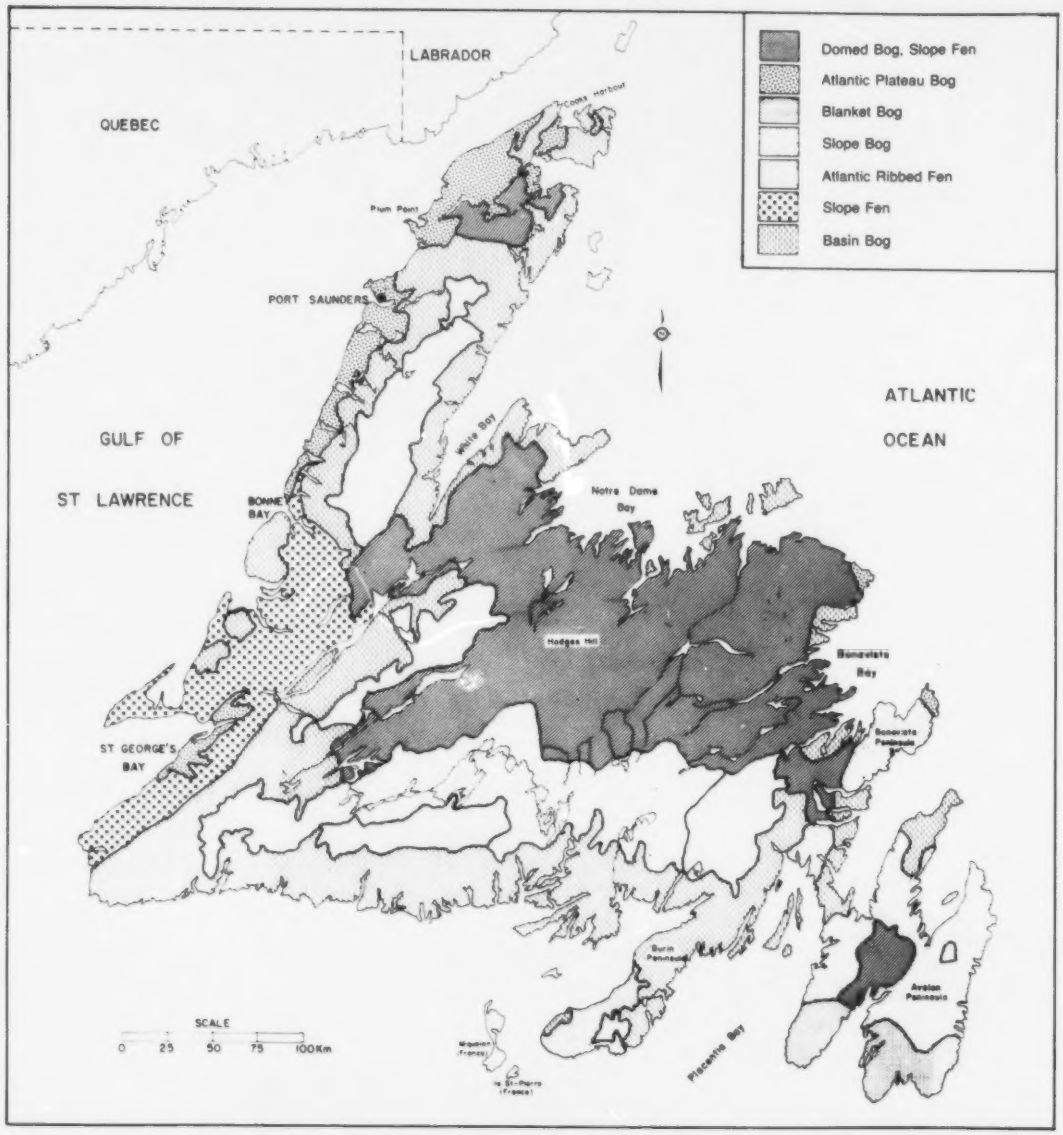
Typical "blanket bog" of Southeast Newfoundland.

Peat is formed from partially decomposed vegetation and inorganic minerals which have accumulated in a water-saturated environment over a period of thousands of years. It is found in great abundance in Newfoundland and is commonly referred to as "bog" or "turf". Peat has a very high moisture content because of the wet environment in which it is formed. On a wet basis scale the moisture content ranges from 90 to 95 per cent.

The build-up of peat in a bog is the first geological step in the formation of coal. Coal is formed from peat which has been subjected to extremely high pressures and temperatures over a period of hundreds of thousands of years beneath the earth's surface. Therefore, peat may be considered as young coal.

In northern European countries peat has for centuries been used as a primary source of fuel. Newfoundland and Labrador has vast reserves of peat. A considerable effort has been made to determine the quantity and quality of these reserves. Demonstration projects to investigate the technical and economic factors associated with commercial fuel peat development have been funded by both the federal and provincial governments.

89-01938/



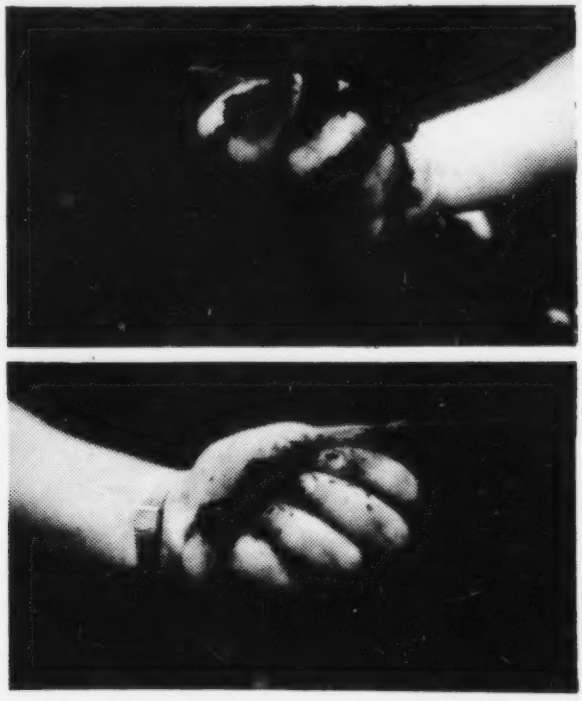
Peatland distribution map showing extent of major peatland types in Newfoundland. Source: Pollett & Wells, 1983

Classification of Peat

There are many systems used to classify peat. Generally they relate to the degree of decomposition and the biological origin. It is important to know the level of decomposition when selecting the peat for a particular purpose. A commonly used system is the "von Post" scale which rates the degree of decomposition on a number scale from H-1 to H-10. Peat rating between H-1 and H-5 is known as moss or peat moss and is only slightly decomposed: the residues of plants are recognizable in it. This class of peat has a high water-retention capacity and is excellent for horticultural use as a soil conditioner. On the upper end of the scale from H-6 to H-10 peat has a higher degree of decomposition and the plant residues are not recognizable. This peat has higher bulk density and a higher energy content than peat on the lower end of the scale. It forms a hard crust when dried and does not easily reabsorb water. H-6 to H-10 peat is therefore best suited for use as fuel. Peat less than H-5 on the von Post scale is not generally used as a fuel source due to its low bulk density, which makes it more costly to transport, handle and burn in solid fuel boilers.

Rating on the von Post Scale

By hand squeezing a sample of peat an experienced person can easily rate its degree of decomposition. Peat on the low end of the von Post scale (H1) will release a clear colourless water between the fingers, and has recognizable plant material residues. For peat on the upper end of the scale (H10) the entire mass will slip through the fingers with no residues.



Peat samples being tested by hand squeezing.
Upper photo shows fuel peat.
Lower photo shows horticultural peat.

A recently completed inventory of the Province's peatlands estimated an area of 1.1 million hectares, approximately 11 percent of the island surface area, to be covered by peat. The peatlands are distributed over the entire province, but the largest concentrations are in the east and south-east regions. Estimating the fuel value of the peat resource is complicated by the numerous variables which must be considered. The vast area of land covered has meant that only a limited number of field samples and depth probes have been taken. Since the volumes of peat are calculated by multiplying the bog area by depth this has resulted in a high degree of error. The degree of decomposition, bulk density, ash content, and calorific values are also not the same for all peat from all bogs, which further complicates any estimates of the energy value of the fuel peat resources.

Horticultural grade peat (less than H-5) which lies on top of the fuel grade peat can vary in depth from a few centimetres to several metres. There is currently a limited market for horticultural peat, so fuel peat which lies underneath the thick layers of horticultural peat overburden (more than about 30 cm) is not economically accessible and is regarded as an unrecoverable fuel reserve.

The Burin and Avalon Peninsulas

The peat in the blanket bogs on the southern tips of the Burin and Avalon Peninsulas is highly decomposed with very little overburden. The high energy content and ease of recovery of this fuel offers potential for a fuel peat industry. In fact, one of the new fuel peat development projects in Canada is currently in progress near the town of St. Shotts in St. Mary's Bay. A fifteen hectare site was developed there for the production of sod peat to supply domestic consumers.

89-01938/

PEAT BOG PREPARATION

Peat bogs require a considerable amount of preparation before the peat can be removed. The moisture content must be reduced to less than 95% (1 part solid to 10 parts water) before production equipment can be used.

Bog Development Plan

The first step in harvesting peat is a detailed survey of the bog to determine the quantity and quality of the peat. The routes of the drainage network and the access roads to the bog are then determined. Then a development plan can be prepared.

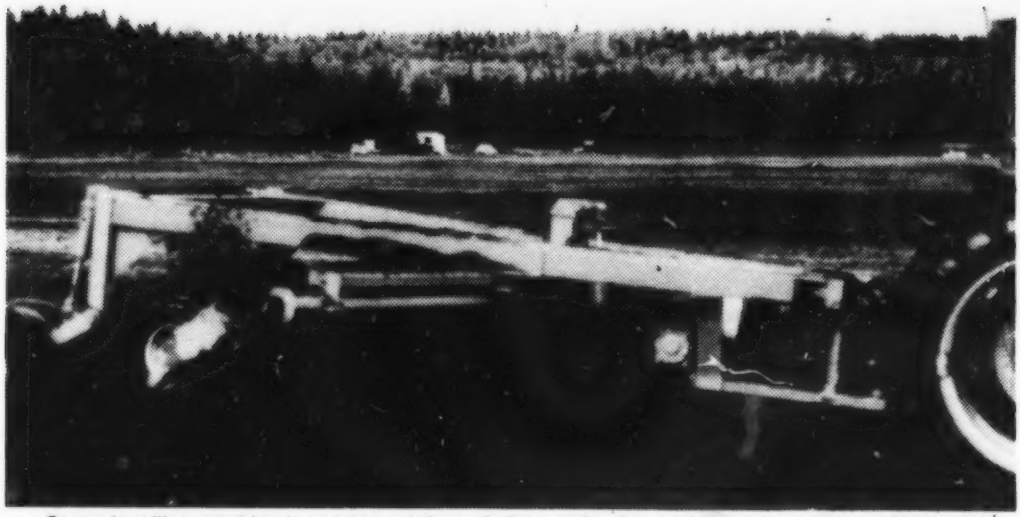
Draining the Bog

To drain the bog, perimeter and outlet ditches should be dug down to the mineral soil by an excavator. A series of V-shaped field ditches are laid at 20 metre intervals and connected to the perimeter ditches to facilitate drainage. These ditches are V-shaped to prevent them from closing in at the top. In Ireland, where large scale peat developments have been in place since the mid 1940s, the bogs are left to drain for five to seven years before surface preparation is undertaken. During this time the moisture content is reduced appreciably. A slight shrinkage of the bog occurs, increasing the bog's stability.

The V-shape of the field drainage ditch prevents the bog surface from closing in.

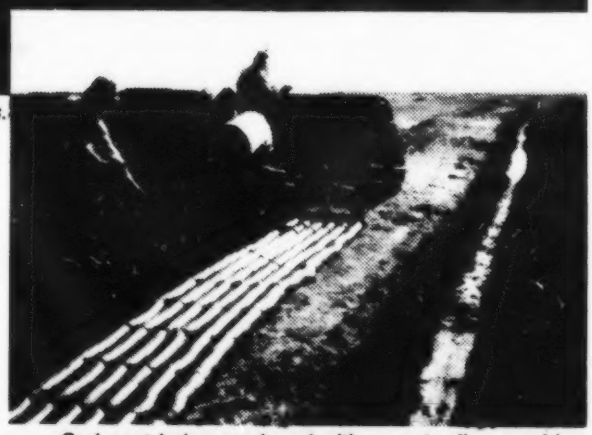
Levelling the Bog

To level the bog surface, the overburden (living vegetation and non fuel-grade peat) is removed with a screw leveller. This machine cuts through the overburden with an auger. It lays the overburden material in rows on the production field. This waste is then loaded into wagons and removed from the site. The result of this process is a smooth peat field which slopes gently towards the nearest drainage ditch.



Screw levelling machine is used to cut through the overburden and leave a smooth profiled surface.

Fully prepared fields with drainage ditches.



Sod peat being produced with an extruding machine.

89-01938/

Harvesting machine used to turn peat and load it into wagons.

Sod peat stockpile.

HARVESTING PEAT

The life expectancy of a commercial peat harvesting operation depends on surface area and depth of fuel grade peat. Most operations in Europe last at least 25 years.

In Newfoundland peat is harvested from prepared fields by either the sod peat or milled peat methods.

Sod Peat Method of Harvesting

An extruding machine cuts into the surface of the prepared bog to a depth of about 100 cm. The machine removes a strip of peat and extrudes it as cylindrical sods about 25 cm long and 7-10 cm in diameter. These sods are similar in shape to small junks of wood. Sods are left on the bog to air dry.

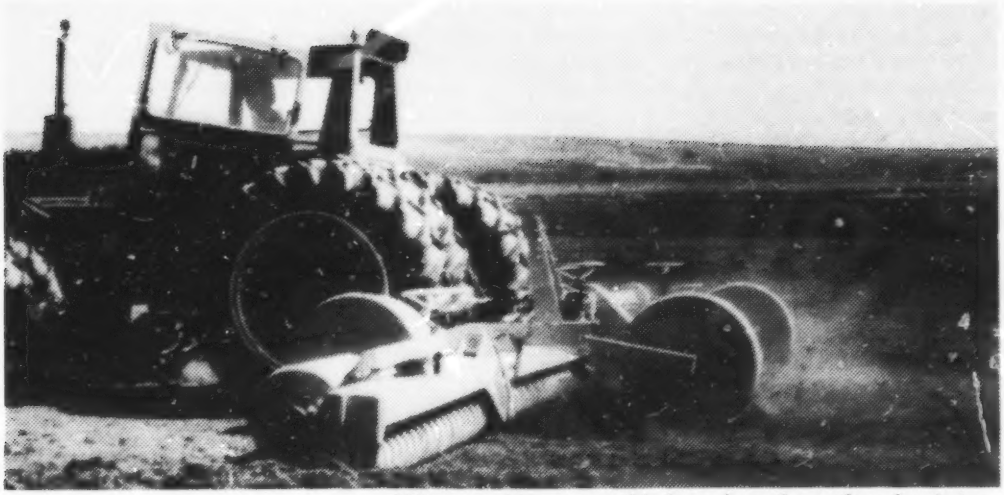
After one week, a protective hard crust forms on the exterior of the sods which prevents damage from any heavy rains. To aid drying the sods are turned about once a week on the fields. When the moisture content of the sods reaches 35-40 per cent (wet basis) they are pushed into rows, loaded into wagons, and stockpiled under cover. At least two harvests of peat a season are desirable to justify the project economically.

Milled Peat Method of Harvesting

Although the surface is prepared much the same as for sod peat, using a screw leveller, the production method and the end product are quite different.

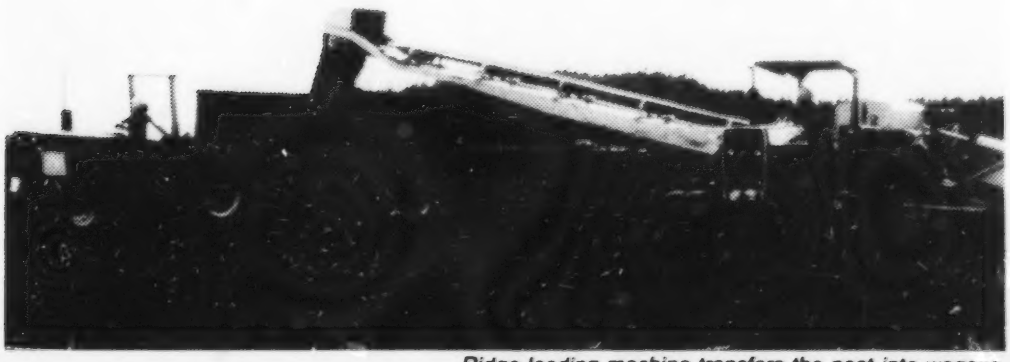
To produce milled peat a 2 cm layer is cut from the bog surface with a horizontal cutting auger. The loose peat is then air-dried and turned once a day with a harrow to speed air drying. The moisture content of the milled peat drops to about 45 percent (wet basis) in 4 or 5 days. The peat is then collected by the ridge or vacuum method.

Ridge Harvesting. The milled peat is pushed by a plow into a ridge in the center of the production field. The bog surface is repeatedly milled until there is enough dry peat to load into wagons using machines equipped with conveyors. The peat is stockpiled at the production site for delivery to users. By compacting the stockpiles with a bulldozer, wind losses and moisture build-up are reduced. This compacting also lessens the chance of spontaneous combustion occurring.



Milling machine cuts a thin layer from the surface for drying.

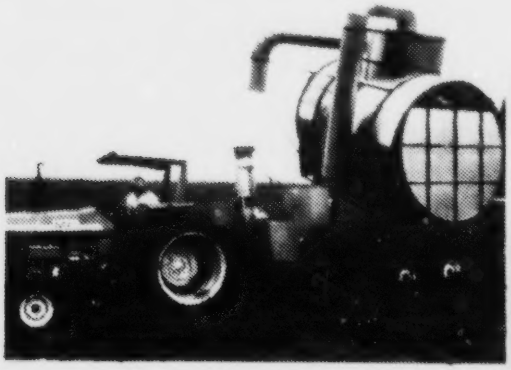
Ridging plough pushes the dried peat layer to the center of the field for collection.



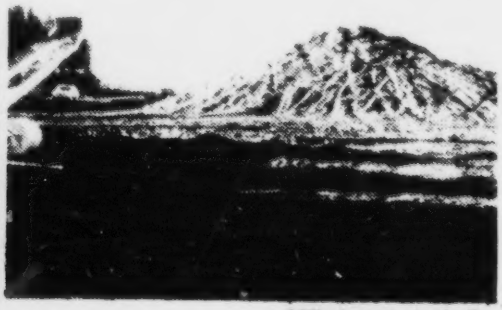
Ridge loading machine transfers the peat into wagons.

89-01938/

Vacuum Harvesting The vacuum method of peat harvesting differs from the ridging method in the means of peat collection only. Large vacuum harvesters drive over the fields gathering the peat into an attached tank. This reduces the drying time because the suction is adjusted to pick up only the lighter, drier particles of peat. The stockpiling procedure is the same as for the ridged method.



Vacuum harvester on production field.



Milled peat stockpile.

ENERGY APPLICATIONS

Fuel Characteristics

Fuel peat has characteristics similar to fuel wood. The energy value of both fuels ranges between 19,000-21,000 kJ/kg of oven-dry material. A major factor to consider when comparing the fuels is the moisture content. Sod peat is usually sold at 35-40 per cent moisture content (wet basis). Green wood contains approximately 40-50 per cent moisture. Seasoned wood has a moisture content of 20 per cent. The lower moisture content means a higher energy output can be achieved. The ash content of peat varies with the location but, in general, it is higher than for wood. The smell of burning peat, while not unpleasant, is distinctly different from wood.

COMPARISON OF VARIOUS FUELS

	Furnace Oil	Coal (Bituminous)	Peat	Wood
Energy value (kJ/kg oven-dried material)	40,000-40,500	28,000-33,000	19,000-21,000	19,000-20,500
Operational Moisture (% wet basis)	0.1	3-8	35-60	20-50
Ash Content (% oven-dried material)	0.3-0.7	4-10	2-10	0.4-0.6
Energy Value at Lowest Operational Moisture (kJ/kg)	N/A	27,050-31,900	11,350-12,650	14,600-15,800
Energy Value at Highest Operational Moisture (kJ/kg)	N/A	25,200-30,150	5,900-6,700	8,100-8,850

Burning Peat; Sod or Milled

Ireland and Finland are just two of the countries where sod peat is burned successfully as a residential, commercial and industrial fuel. It is currently being used by many homeowners on the Southern Avalon Peninsula. Combustion tests done on locally produced sod peat have proven that it burns quite well in airtight woodstoves.

In small applications sod peat is preferred over the milled peat because it is less dusty, handling equipment is simpler, boiler systems are cheaper and operating costs are lower. Sod peat is competitive with milled peat in plants with a capacity up to 10 megawatts. In plants with a greater energy demand the significantly cheaper production costs of milled peat justify the extra expense of the milled peat boiler system. Milled peat boiler systems are often used in co-generation plants where steam is produced for electricity generation and for heating.

ENVIRONMENTAL CONSIDERATIONS

Air and Water Quality

The development of peatlands raises some concern over the effect of large scale harvesting on the air and water quality in the surrounding areas.

Dust from the milled harvesting process can be a real nuisance for the workers at the site and for nearby communities. The dust problem can be overcome through improved production planning, careful site location (downwind from nearby communities), and forested buffer zones. Sealed, air-conditioned cabs are available for many machines used to harvest peat. Site workers should wear protective breathing devices. In St. Shotts, where the sod peat method of production is used, dust has not caused any noticeable problems.

Effects of drainage from the bogs on nearby lakes and streams depend on the pH of the drainage water and on the materials suspended in it. Monitoring of nearby lakes and streams in Newfoundland and Finland has shown that there is some change in the water quality but only in the immediate area of the bog, and it is not considered harmful.

Animal and Plant Life

The development of large areas of the peatlands causes permanent changes to animal and plant life. These concerns are recognized by government. Should a substantial fuel peat industry develop in the province, every effort will be made to maintain the balance between conservation and development.

Potential Uses of Cutaway Areas

After the fuel peat has been removed from the site, the land may be reused for agriculture, aforestation, pasture lands, or for recreational purposes. The ultimate choice will be influenced by the needs of the people in the areas, the site location, the quality of underlying mineral soil, and environmental considerations.

In European countries, once a peat site has been depleted it is customary to leave a layer of peat about 50 cm thick. This peat layer is mixed with the underlying mineral soil to suit future uses of the land.

89-01938/

CONCLUSION

It is possible to have a viable fuel peat industry in Newfoundland. In areas where fuel peat is not buried beneath a deep overburden of horticultural peat, there is potential for commercial fuel peat development.

The use of peat to fuel industrial sized plants was demonstrated at the Abitibi-Price paper mill at Grand Falls.

Homeowners on the Avalon Peninsula were burning sod peat in the winter of 1984-85.

REFERENCES

Finn Energy '79, Proceedings of Seminar in the U.S.A. and Canada, January, 1979.

Ministry of Trade and Industry of Finland, **Report on Energy Use of Peat**, 1980, Helsinki.

Monenco Ontario Limited, **Peat in Ontario**, 1981.

Punwani, D. V., **Peat as an Energy Alternative: An Overview,** 1980, Institute of Gas Technology, Chicago.

Tibbetts, T. E. and Igmail, A. **On the Feasibility of Mining Peat for Power Generation in Canada,** December, 1980, C. I. M. Bulletin.

U.S. Department of Energy, **Peat Prospectus**, Washington, D.C., July, 1979.

Wells, E. D. and Pollett, F. C. Peatlands. In Biography and Ecology of the Islands of Newfoundland (G. R. South, ed.). Dr. W. Junk Publishers, the Hague 1983.

CANADA/NEWFOUNDLAND CREDA INFORMATION FOLDERS

- New Housing
- Housing Retrofit
- Commercial Building Retrofit
- Greenhouses
- Fish Plants and Vessels
- Swimming Pools
- Arenas
- Hospitals
- Schools
- Waste Heat Recovery
- Electrical Load Management
- Heat Pumps
- Large Scale Wood Heating
- Fuel Peat in Newfoundland
- Energy from Waste

For these folders, or more information on energy projects funded under the Canada/Newfoundland CREDA program, contact:

Information Section, Energy Branch
Department of Mines and Energy
P. O. Box 4750, St. John's, Nfld., A1C 5T7
(709) 576-2411

or

Energy, Mines and Resources Canada
P. O. Box 65, Atlantic Place, 215 Water St.,
St. John's, Nfld., A1C 6C9
(709) 772-4365